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Title: Trap-Insensitive Quantum Dot-Sensitized Solar Cells

Author(s): Du, Jun
Singh, Rohan
Klimov, Victor Ivanovich

Intended for: Job interview
Report

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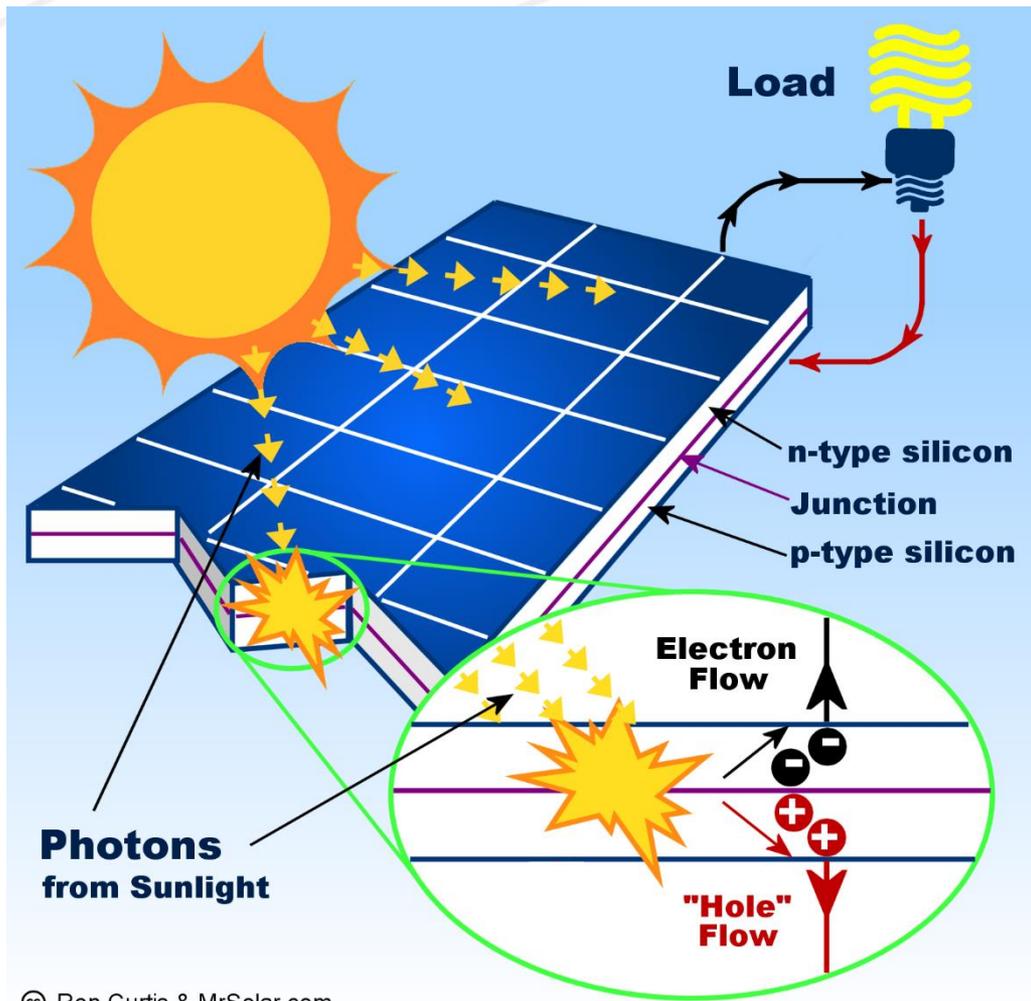


Trap-Insensitive Quantum Dot-Sensitized Solar Cells

Jun Du, Rohan Singh, Victor I Kilmov

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Working principle of solar cells



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Generation of carrier



materials

efficiency

techniques

costs

market



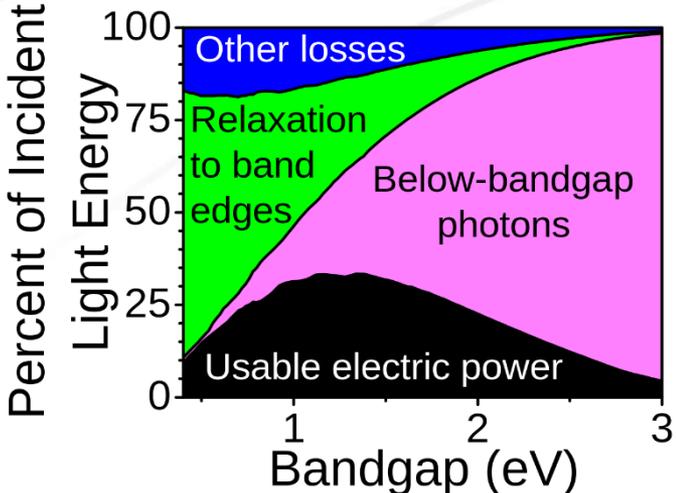
Separation of carrier

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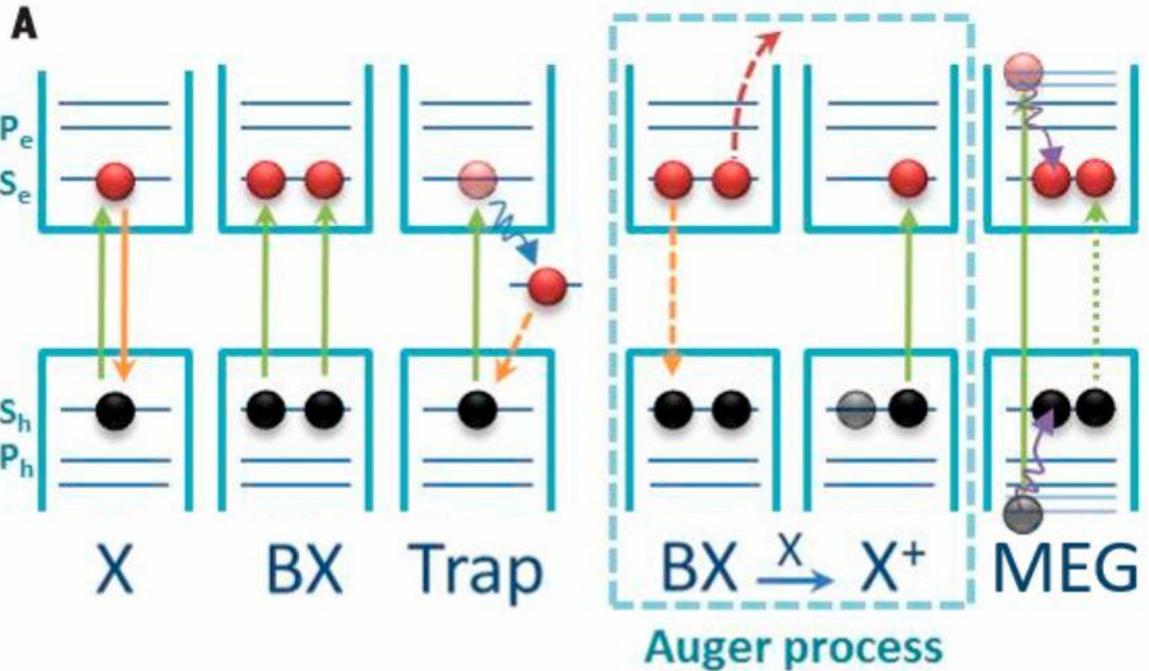
Why we choose quantum dots to make solar cells?

Shockley-Queisser limit



- Tandem cells
- Light concentration
- Intermediate band photovoltaics
- Photon upconversion
- Thermal photon upconversion
- Hot electron capture
- Multiple excitation generation*
- Fluorescent downconversion
- Thermophotovoltaic downconversion

en.wikipedia.org/wiki/Shockley-Queisser_limit

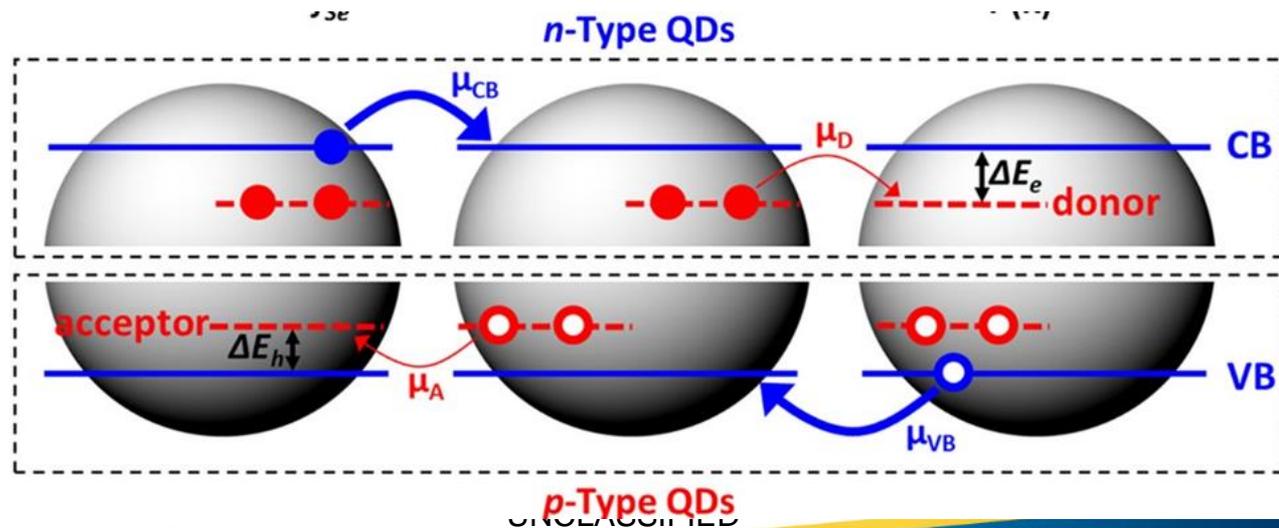
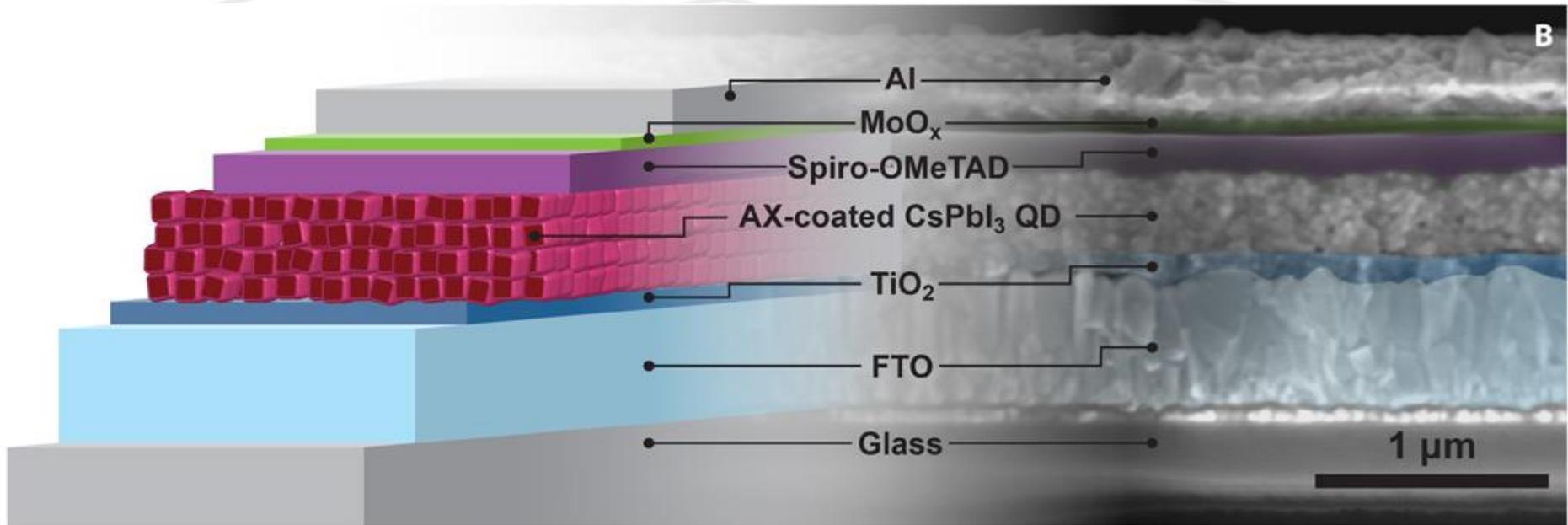


Beyond SQ limit (44%)

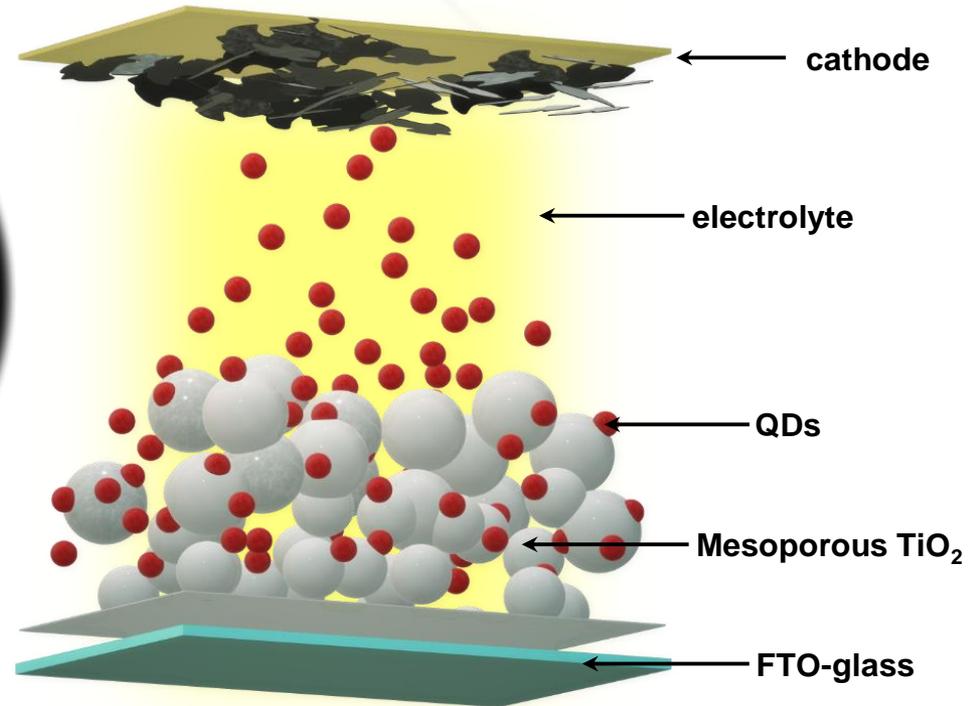
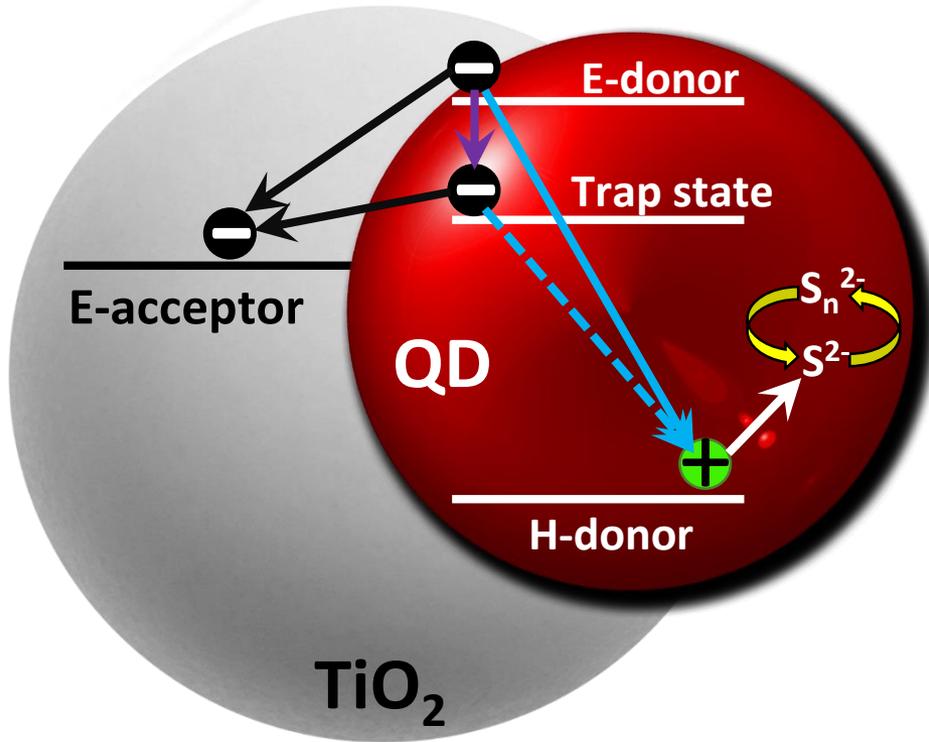
Economically feasible

Science 353 885 (2016)

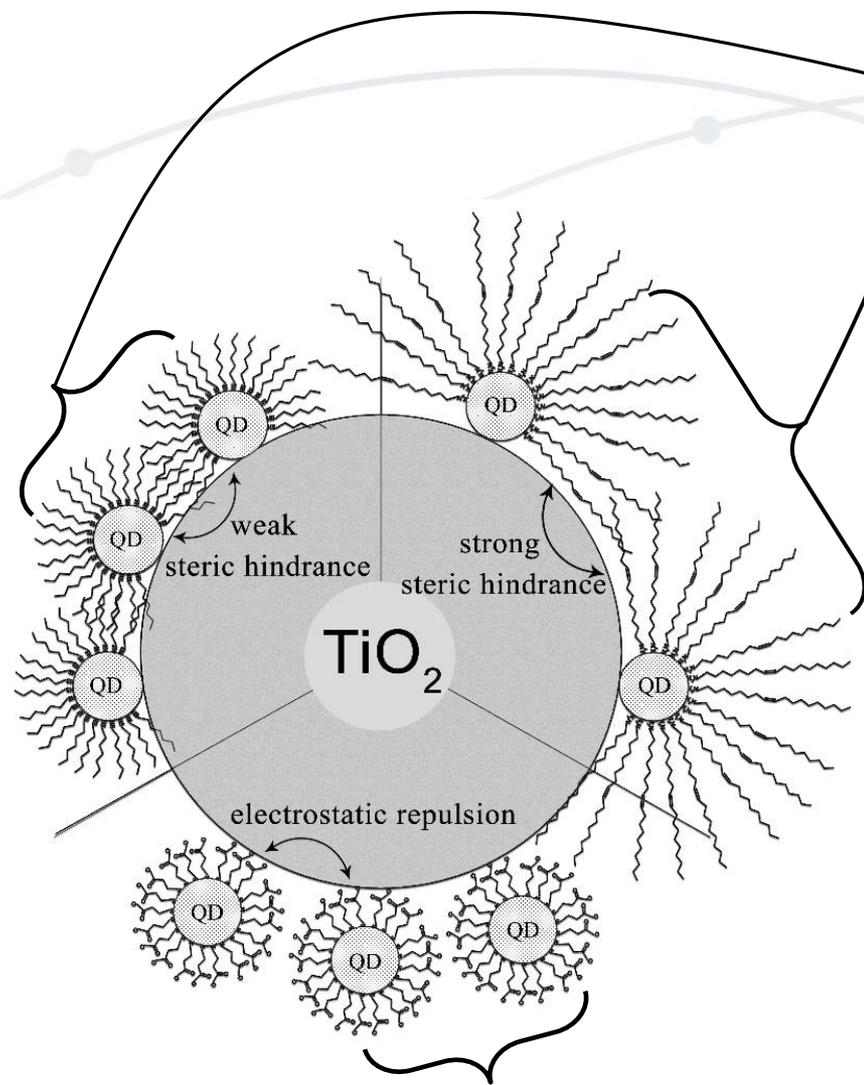
Solid State Heterojunction Quantum Dot Solar Cells



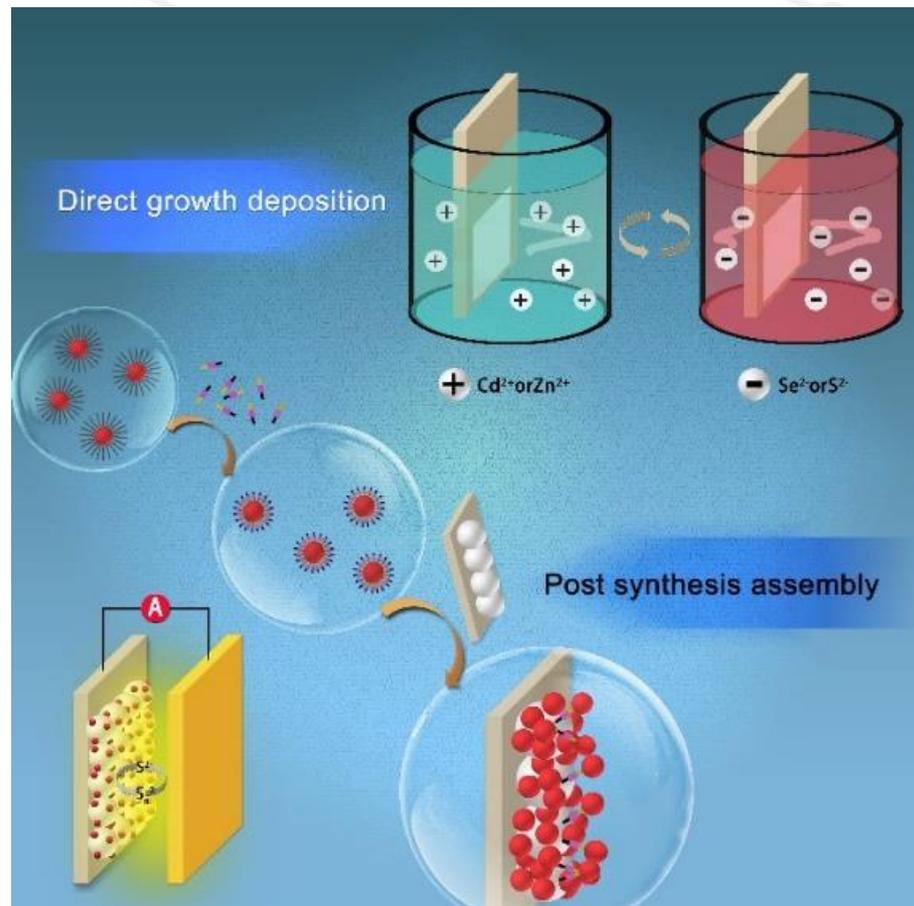
Quantum Dot-Sensitized Solar Cells



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Labile L-type ligands

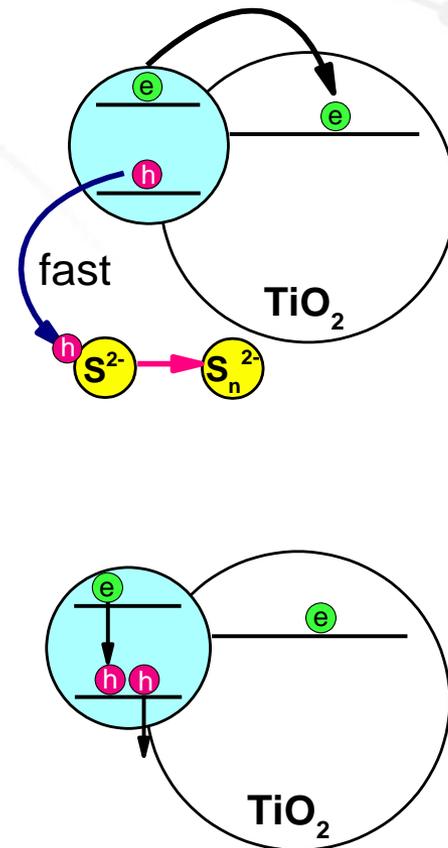
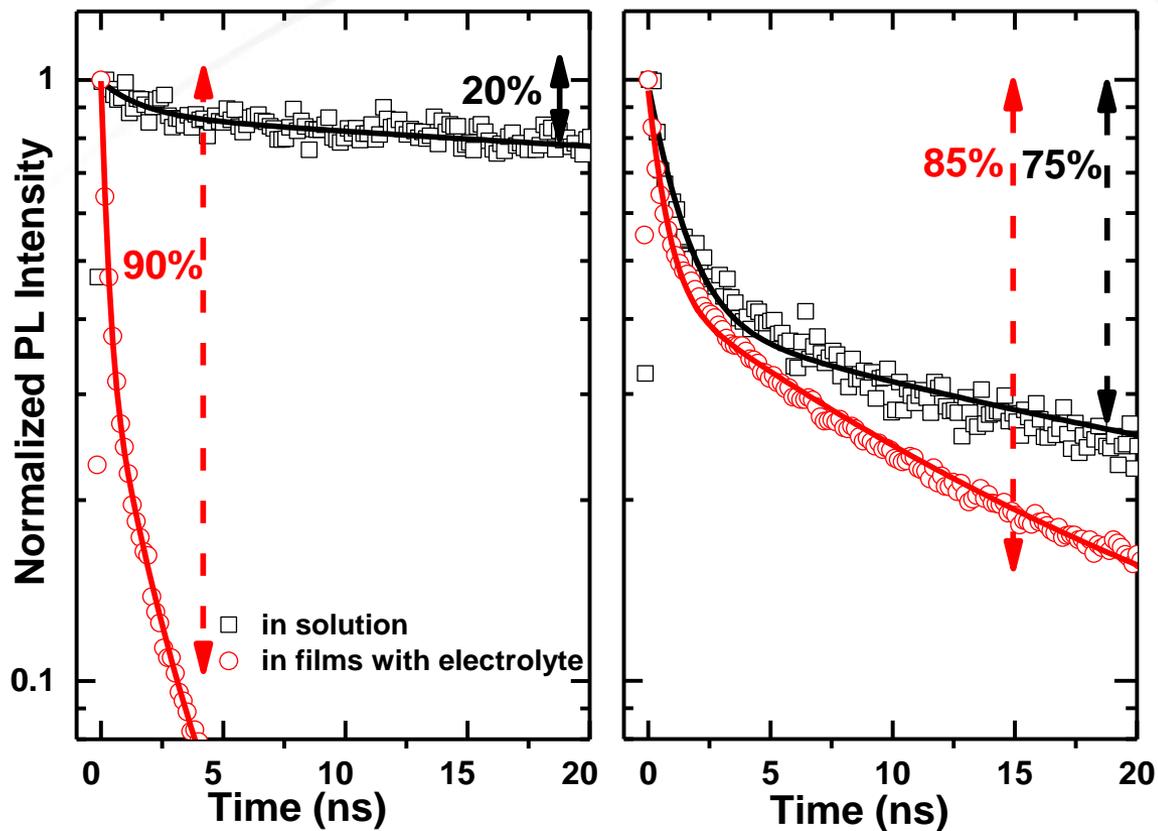


Z-type ligands

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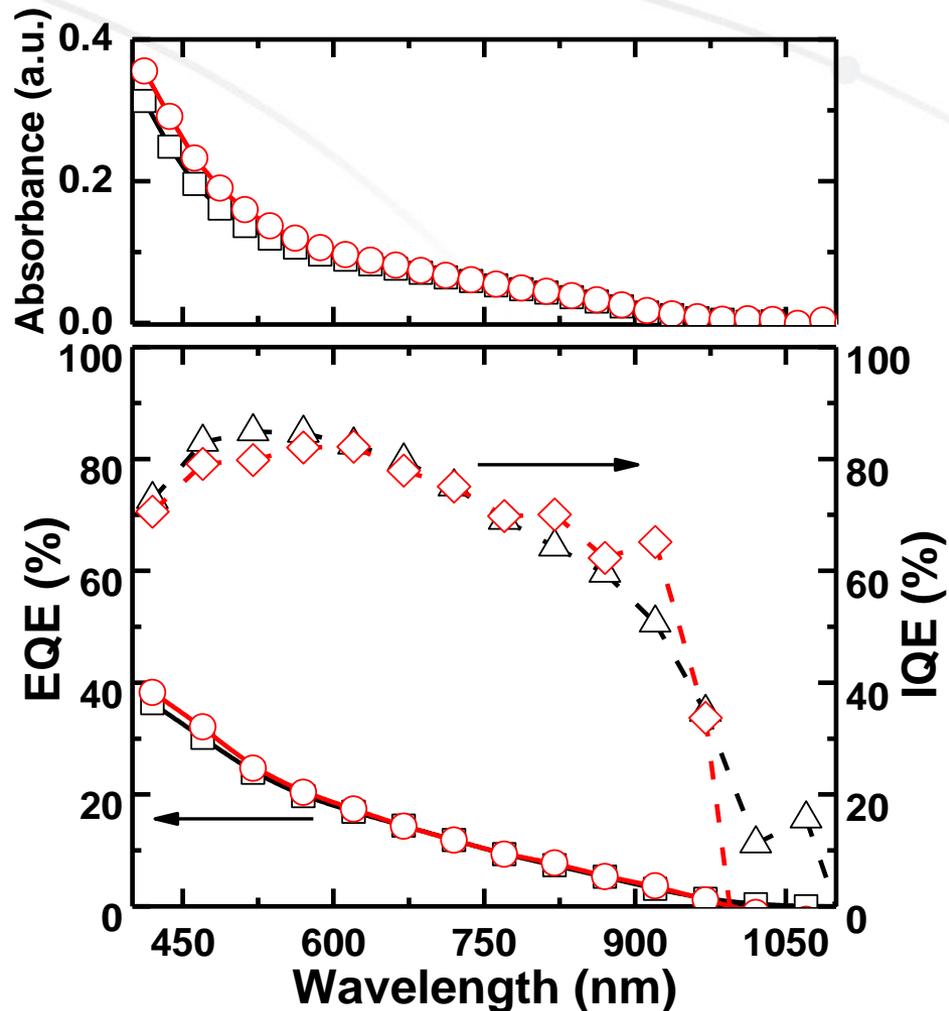
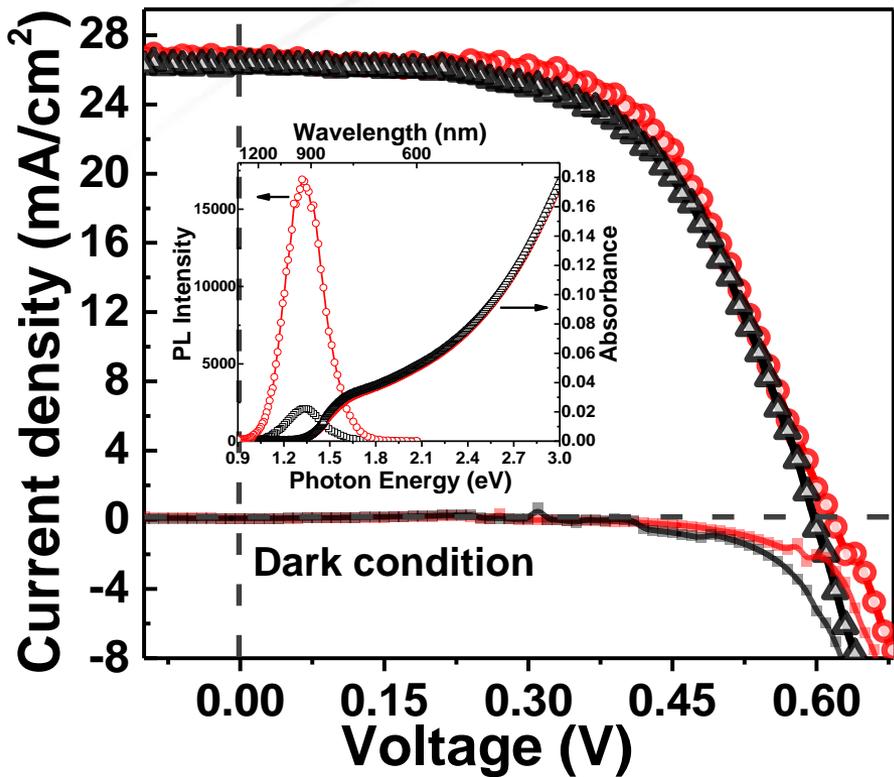
Can time-resolve optical spectra reflect the electron transfer?



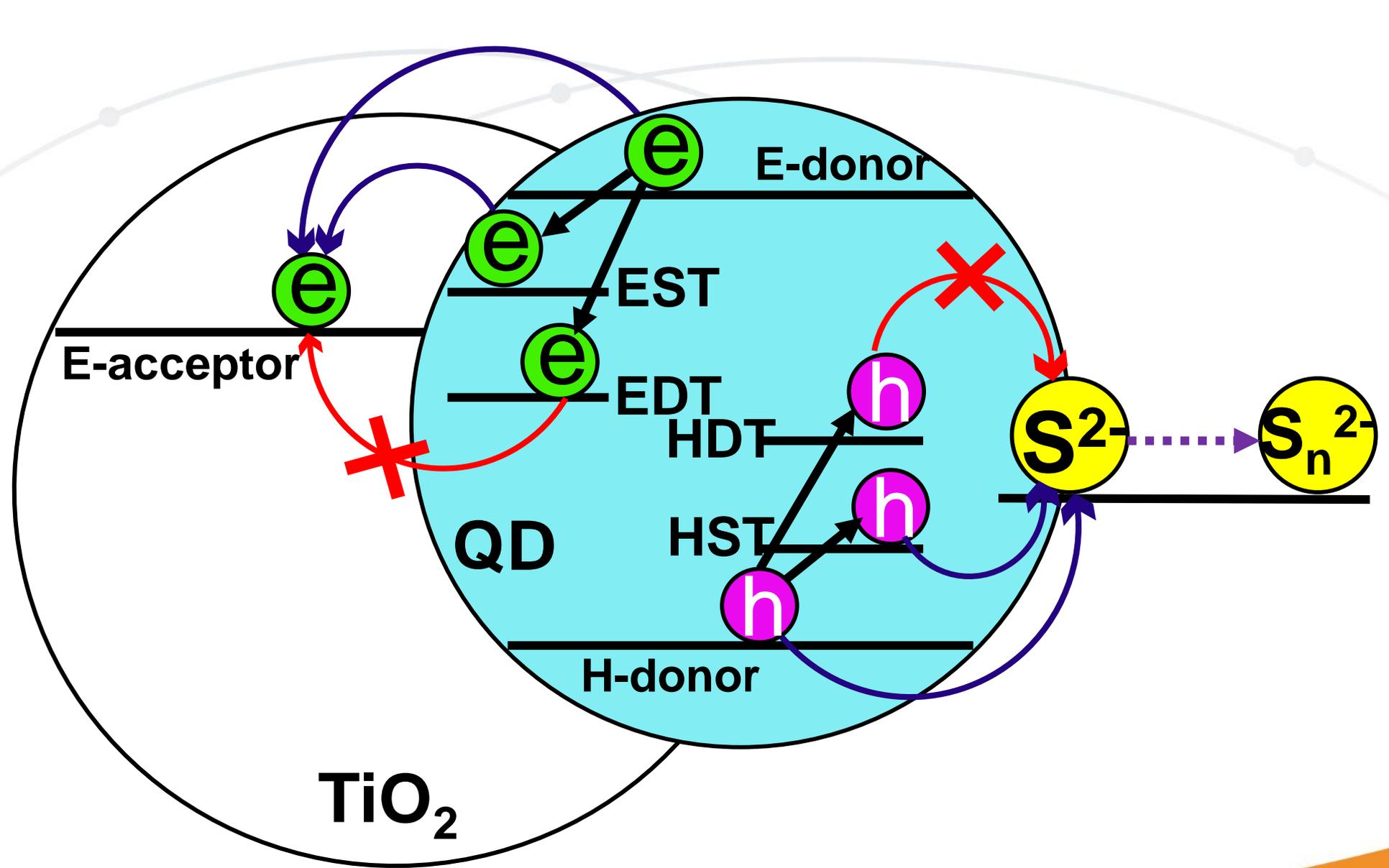
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Almost identical carrier extraction efficiency.

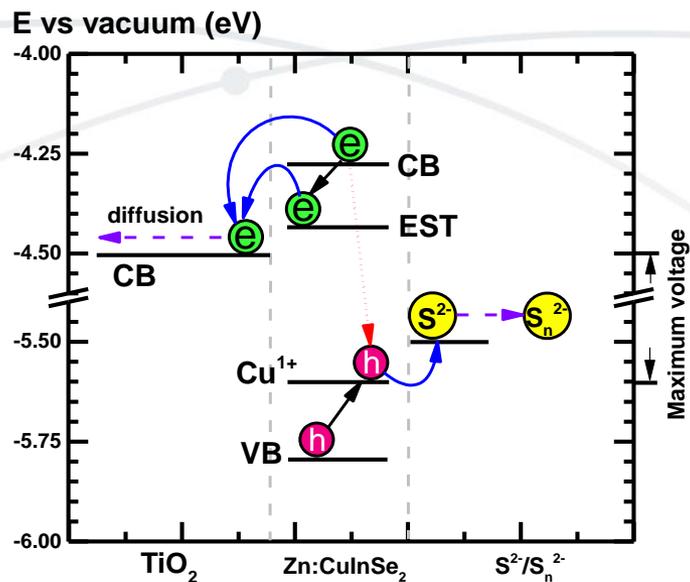
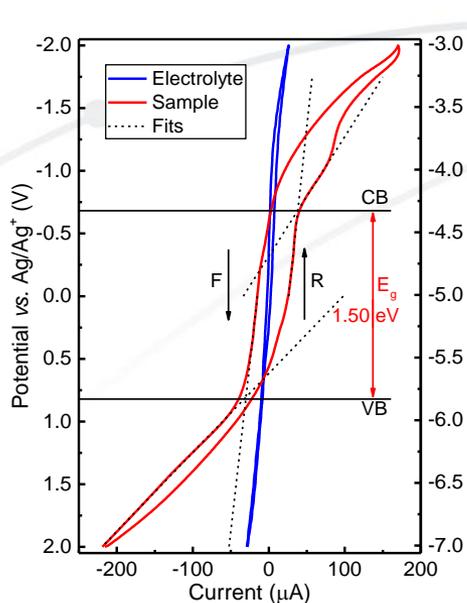


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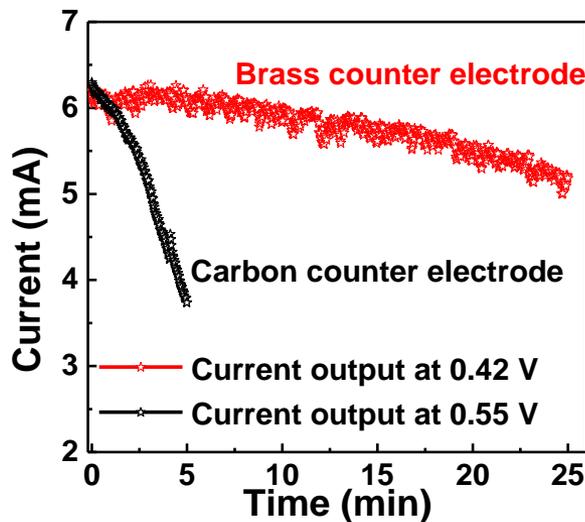
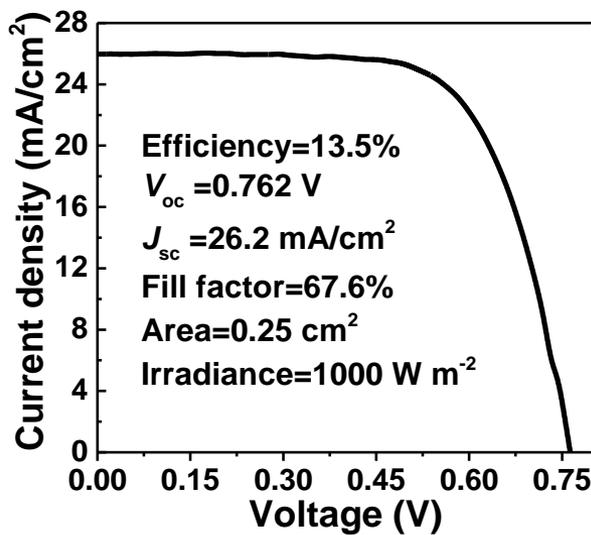


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Optimal energy level alignment of donor-acceptor for efficient interfacial electron dissociation, and a high voltage.



Reducing series resistance and shunt resistance for high FF.

Long-term stability.

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Thank you very much

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